

**Ecology of heather.**—One of the most commendable features of modern ecology is seen in the present tendency to focus attention on some particular plant which is examined as to its responses and limitations. A notable example of this type of investigation is seen in Miss RAYNER'S studies of *Calluna vulgaris*. In a preliminary paper<sup>12</sup> she pointed out that while the plant has been regarded as a typical calciphobe, it occurs in sharply defined communities on the chalk downs in Wiltshire and Berkshire, and appears able to compete with the vegetation characteristic of the downs. According to this investigation the heather communities appeared limited to a heavy rich loamy soil relatively high in magnesium content and neutral in reaction. Beyond these communities there was a poor chalk soil with 40 per cent of calcium carbonate.

An examination of the germination and seedling habits of *Calluna*<sup>13</sup> showed that the seedlings developed normally upon the soil from the heather areas and abnormally upon the chalk soil. Upon the latter the germination was reduced and retarded, the development of the root and shoot arrested, and the leaves were small in size and red in color. The seedlings were found to be infected with a mycorrhizal fungus shortly after germination, the mycelium coming from the seed coat which seems to have been infected while still in the ovary. Seed can be sterilized with no effect upon germination, but in the absence of infection complete arrest of root formation occurs, showing the relation of *Calluna* to the root fungus to be obligate.

A further examination of this symbiosis,<sup>14</sup> already noted in this journal,<sup>15</sup> proved even more conclusively its obligate character and the absence of root development in sterile cultures. The fungus was found to be present in all parts of the plant infecting the testa, but not the embryo and endosperm of the seed. The fungus was isolated, grown in pure cultures, and sterile seedlings were inoculated with resulting normal development.

In the most recent contribution Miss RAYNER<sup>16</sup> has succeeded in demonstrating by experimental cultures that *Calluna vulgaris* will not grow on calcareous soils because of an inimical factor, chemical in nature, present in such soils. The exact chemical character of this factor is as yet unknown, but it seems probable that it is effective by altering the infectibility of the root cells of the seedlings and their relations with the mycelium after infection. It does not seem to affect the fungus when growing outside the plant.—GEO. D. FULLER.

<sup>12</sup> RAYNER, M. C., and JONES, W. N., Preliminary observations on the ecology of *Calluna vulgaris* on the Wiltshire and Berkshire Downs. *New Phytol.* 10:227-240. figs. 2. 1911.

<sup>13</sup> ———, The ecology of *Calluna vulgaris*. *New Phytol.* 12:59-76. pl. 1. figs. 2. 1913.

<sup>14</sup> ———, Obligate symbiosis in *Calluna vulgaris*. *Ann. Botany* 29:97-153. pl. 6. figs. 4. 1915.

<sup>15</sup> BOT. GAZ. 60:166. 1915.

<sup>16</sup> RAYNER, M. C., The ecology of *Calluna vulgaris*. II. The calcifuge habit. *Jour. Ecol.* 9:60-74. pl. 1. 1921.